CLAIMS

What is Claimed is:

1. A monitoring system for monitoring the voltage potential of fuel cells in a fuel cell stack, said system comprising:

a wheatstone bridge, said wheatstone bridge including at least one giant magnetoresistive (GMR) resistor and two output ports;

a conductor positioned proximate to the wheatstone bridge;

a plurality of switches electrically coupled to the fuel cells and to the conductor, said switches being selectively switched on and off to separately and selectively couple each fuel cell in the fuel cell stack to the conductor and generate a current flow therethrough, wherein a magnetic field generated by the current flow through the conductor reduces the resistance of the GMR resistor and unbalances the wheatstone bridge; and

a differencing amplifier electrically coupled to the output ports of the wheatstone bridge, said differencing amplifier providing an output signal indicative of the voltage potential of the selected fuel cell.

2. The system according to claim 1 wherein the switches are FET switches.

3. The system according to claim 1 wherein the at least one GMR resistor is two GMR resistors.

4. The system according to claim 1 wherein the conductor is an electrical trace positioned beneath the wheatstone bridge.

5. The system according to claim 1 further comprising a polarity reverser, said polarity reverser reversing the polarity of the current from the fuel cells before the current is applied to the conductor so that the current through the conductor is always in the same direction.

6. The system according to claim 1 further comprising at least one voltage divider electrically coupled between the fuel cells and the conductor.

7. The system according to claim 1 further comprising a controller for controlling the switches to separately measure the voltage potential of each fuel cell and for receiving the output signal from the amplifier.

8. The system according to claim 7 further comprising a plurality of opto-isolators for isolating the high voltage of the fuel cell stack and the switches from the low voltage of the controller.

9. The system according to claim 1 wherein the system monitors the fuel cell stack on a vehicle.

10. A monitoring system for monitoring the voltage potential of fuel cells in a fuel cell stack, said system comprising:

a wheatstone bridge, said wheatstone bridge including at least one giant magnetoresistive (GMR) resistor and two output ports;

an electrical trace positioned beneath the wheatstone bridge;

a plurality of FET switches electrically coupled to the fuel cells and to the trace, said FET switches being selectively switched on and off to separately and selectively couple each fuel cell in the fuel cell stack to the trace and generate a current flow therethrough, wherein a magnetic field generated by the current flow through the trace reduces the resistance of the GMR resistor and unbalances the wheatstone bridge;

a differencing amplifier electrically coupled to the output ports of the wheatstone bridge, said differencing amplifier providing an output signal indicative of the voltage potential of the selected fuel cell; and

a controller for controlling the switching of the FET switches to separately measure the voltage potential of each fuel cell and for receiving the output signal from the amplifier.

11. The system according to claim 10 further comprising a polarity reverser, said polarity reverser reversing the polarity of the current from the fuel cells before the current is applied to the trace so that the current through the trace is always in the same direction.

12. The system according to claim 10 further comprising at least one voltage divider electrically coupled between the fuel cells and the trace.

13. The system according to claim 10 further comprising a plurality of opto-isolators for isolating the high voltage of the fuel cell stack and the FET switches from the low voltage of the controller.

14. A method for monitoring the voltage potential of fuel cells in a fuel cell stack, said method comprising:

providing a wheatstone bridge including at least one giant magnetoresistive (GMR) resistor and two output ports;

providing a conductor positioned proximate to the wheatstone bridge;

selectively and separately electrically coupling the fuel cells to the conductor to generate a current flow through the conductor, wherein a magnetic field generated by the current flow through the conductor reduces the resistance of the GMR resistor and unbalances the wheatstone bridge; and

electrically coupling the output ports of the wheatstone bridge to a differencing amplifier, said differencing amplifier providing an output signal indicative of the voltage potential of the selected fuel cell.

15. The method according to claim 14 wherein selectively and separately electrically coupling the fuel cells to the conductor includes using FET switches to selectively and separately electrically couple the fuel cells to the conductor.

16. The method according to claim 14 wherein providing a conductor positioned proximate to the wheatstone bridge includes providing an electrical trace positioned beneath the wheatstone bridge.

17. The method according to claim 14 wherein providing a wheatstone bridge includes providing a wheatstone bridge including two GMR resistors.

18. The method according to claim 14 further comprising providing a polarity reverser for reversing the polarity of the current from the fuel cells before the current is applied to the conductor so that the current through the conductor is always in the same direction.

19. The method according to claim 14 further comprising providing at least one voltage divider electrically coupled between the fuel cells and the conductor.

20. The method according to claim 14 wherein the fuel cell stack is on a vehicle.